



2013 U.S. Geological Survey Petroleum Resource Assessment of the Bakken and Three Forks Formations

Williston Basin Province
Montana, North Dakota, and South Dakota

Oil Consumption and Production

- **6.9 billion barrels of oil consumption by U.S. annually (EIA)**
- **Production to date¹**
 - **Williston Basin: 3.3 billion barrels of oil**
 - **Bakken: 673 million barrels of oil**
 - **Three Forks: 46 million barrels of oil**
 - **~22% of Williston Basin production has been from the Bakken-Three Forks**

1: Production numbers from IHS Energy Group, April 2013

Why Assess the Bakken... Again?

- Three Forks Formation not assessed in 2008
- Increased geologic data and knowledge
- Substantial increase in number of wells
- Longer well production histories
- New technology and well completion techniques
- Increased cooperation from industry providing additional geologic, exploration, and development information

Non USGS Cooperators

Industry

- Cirque Resources
- Conoco Philips
- Continental Resources
- Cornerstone Natural Resources
- Denbury Resources
- Enerplus Corp.
- Fidelity Exploration & Production
- Hess Corp.
- Kodiak Oil & Gas
- Marathon Oil
- Mike Hendricks
- Mike Johnson
- Newfield Exploration
- QEP Resources
- Samson Resources
- Slawson Exploration
- Whiting Petroleum
- WPX Energy

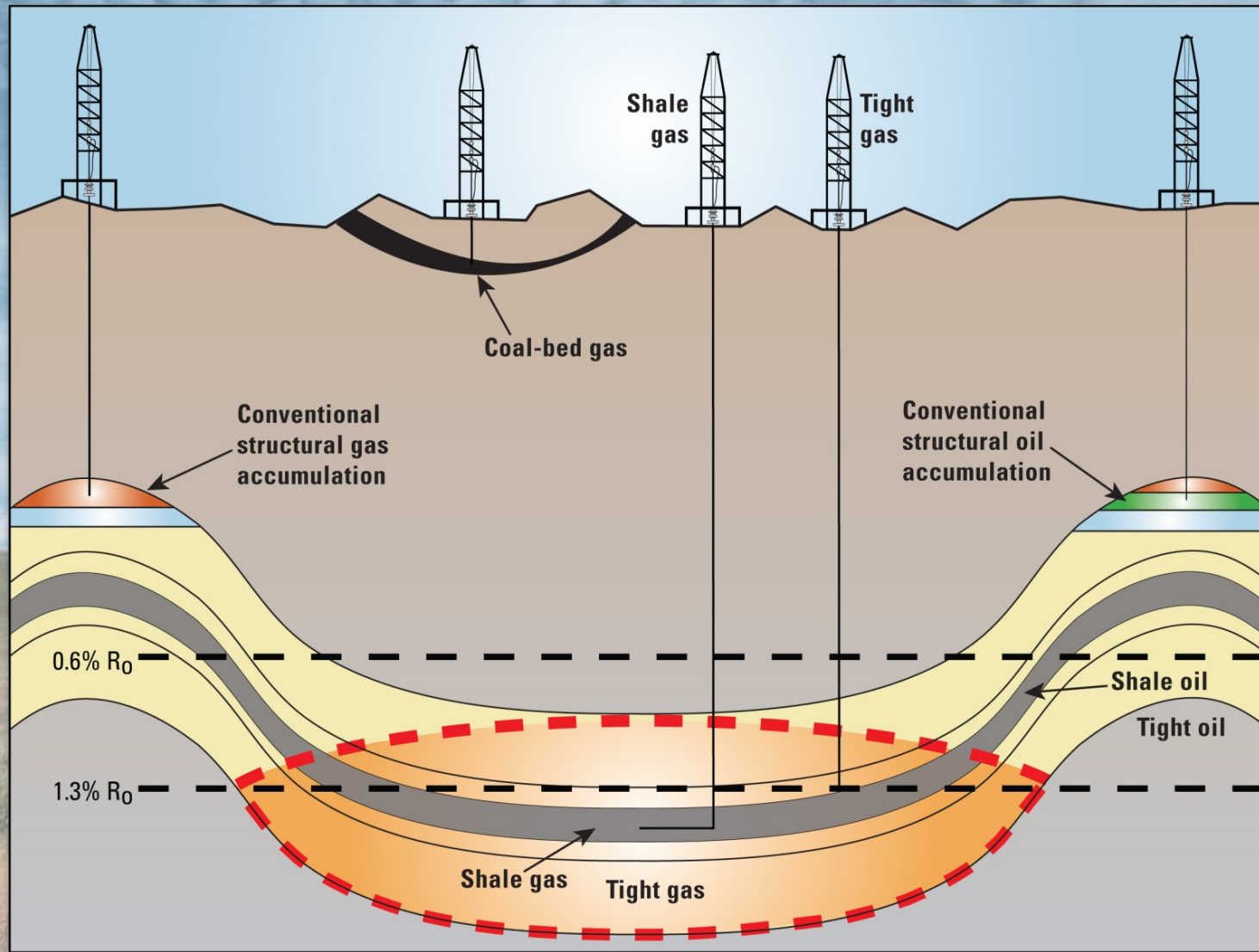
State Agencies

- North Dakota Geological Survey
- North Dakota Industrial Commission
- Montana Board of Oil and Gas

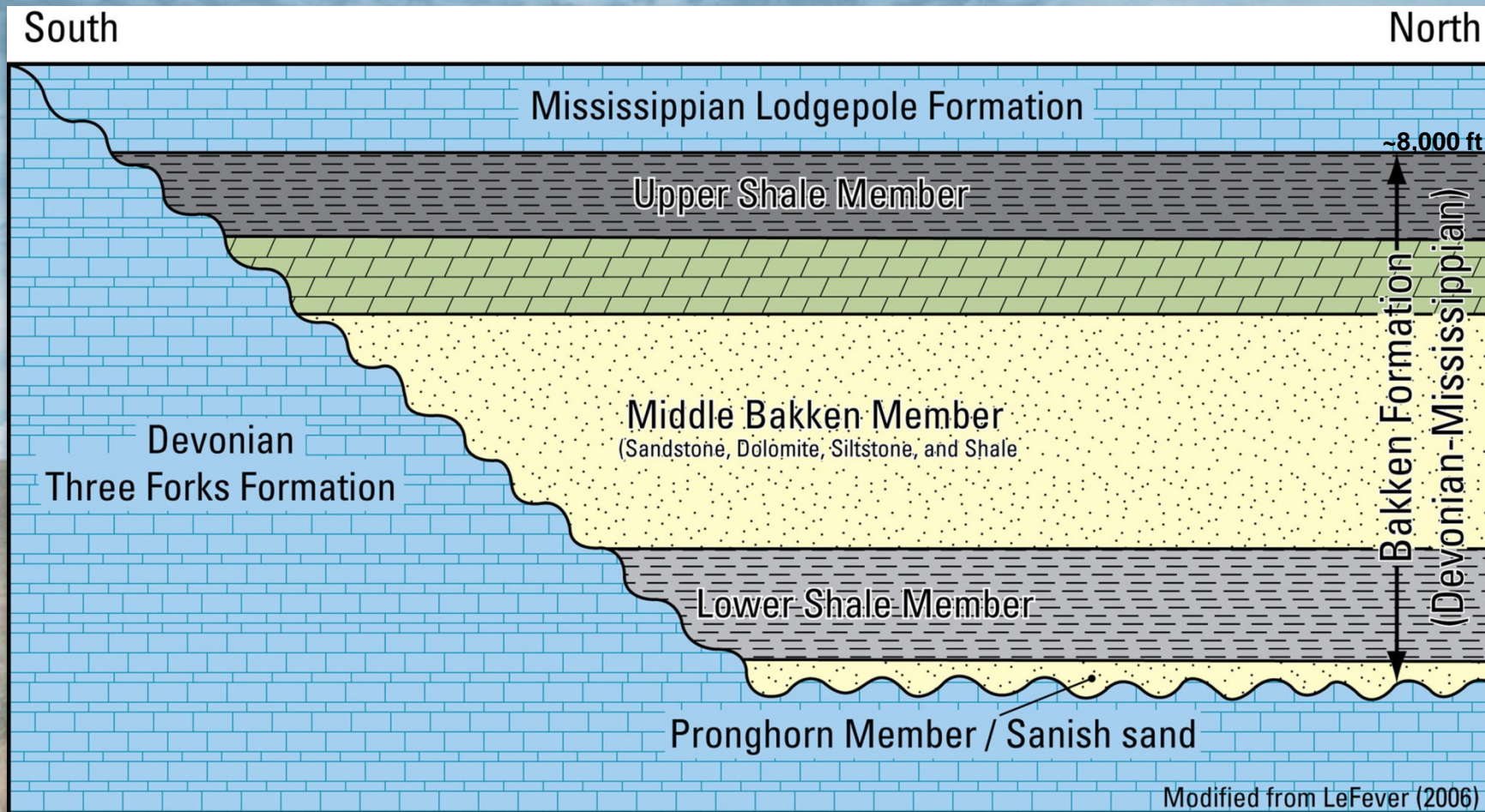
Academia

- Colorado School of Mines

Conventional vs. Continuous Resources



Bakken Petroleum System



Bakken Exploration and Production-up to 2008

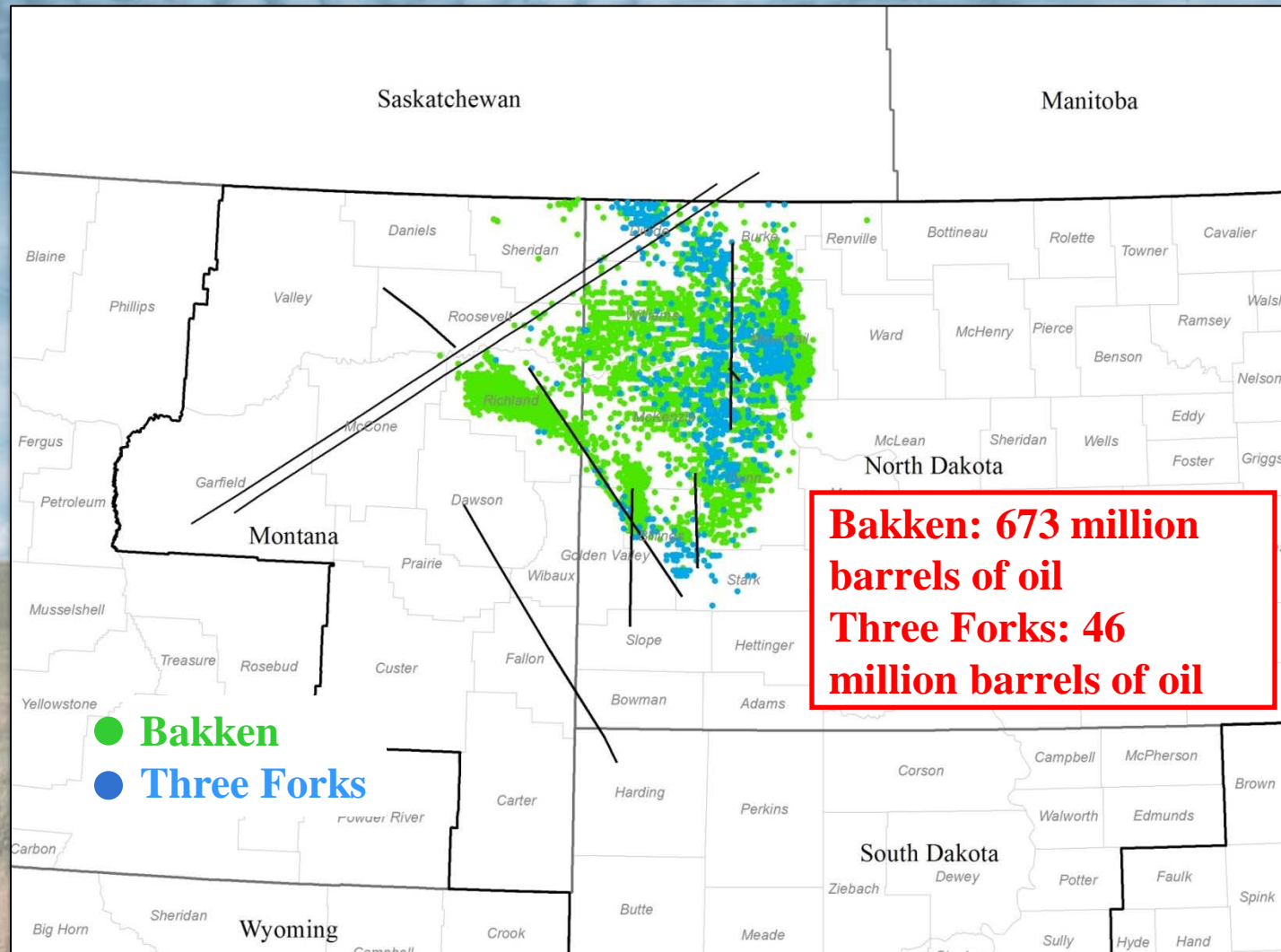
A map of the Northern Plains region, showing the states of North Dakota, South Dakota, Montana, Wyoming, and parts of Saskatchewan, Manitoba, and Colorado. The map highlights the Bakken oil field, which is a large, irregularly shaped area in the central-northern part of the region, primarily within North Dakota and Montana. The field is outlined in black and filled with a light yellow color. Numerous small black dots are scattered throughout the field, representing individual oil wells. A red rectangular box is overlaid on the map, containing the text "150 million barrels of oil produced". The map also shows the names of various counties and towns in the region, such as Blaine, Phillips, Valley, Daniels, Sheridan, Roosevelt, Williams, Mountrail, Ward, McHenry, Pierce, Benson, Ramsey, Walsh, Nelson, Eddy, Foster, Griggs, Barnes, and Dickey in North Dakota; Fergus, Petroleum, Garfield, McCone, Dawson, Prairie, Wibaux, Golden Valley, Stark, Hettinger, Adams, Bowman, Harding, Perkins, Corson, Campbell, McPherson, Brown, Walworth, Edmunds, Faulk, Spink, Sully, Hyde, Hand, Stanley, Meade, Butte, Crook, and Campbell in Montana; and Big Horn, Yellowstone, Treasure, Rosebud, Custer, Fallon, and Powder River in Wyoming. The map is set against a background of a blue sky with white clouds and a green field with yellow flowers.

150 million barrels of oil produced

USGS



Present Bakken Exploration and Production

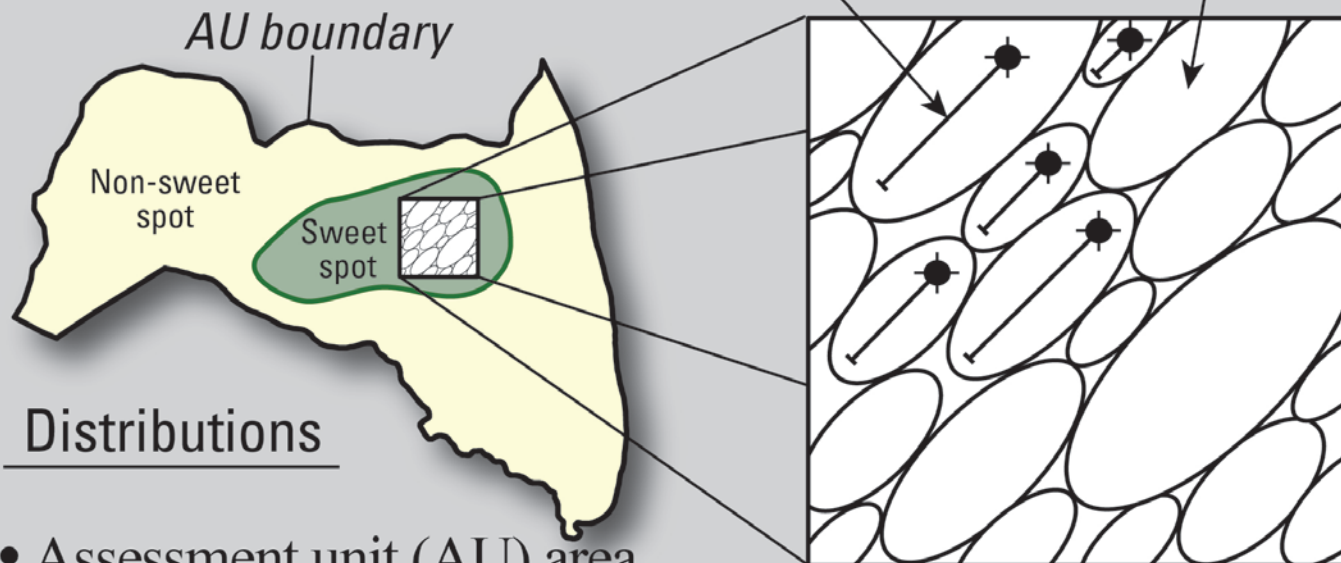


USGS Assessment Methodology

For Continuous-Type Accumulations

- **Based on Geology and Geological Models**
- **Identify and Outline Total Petroleum System(s)**
- **Undiscovered, Technically Recoverable Resource**
 - **Not Economically Recoverable Resource Estimates**
 - **Not In-Place Resource Estimates**

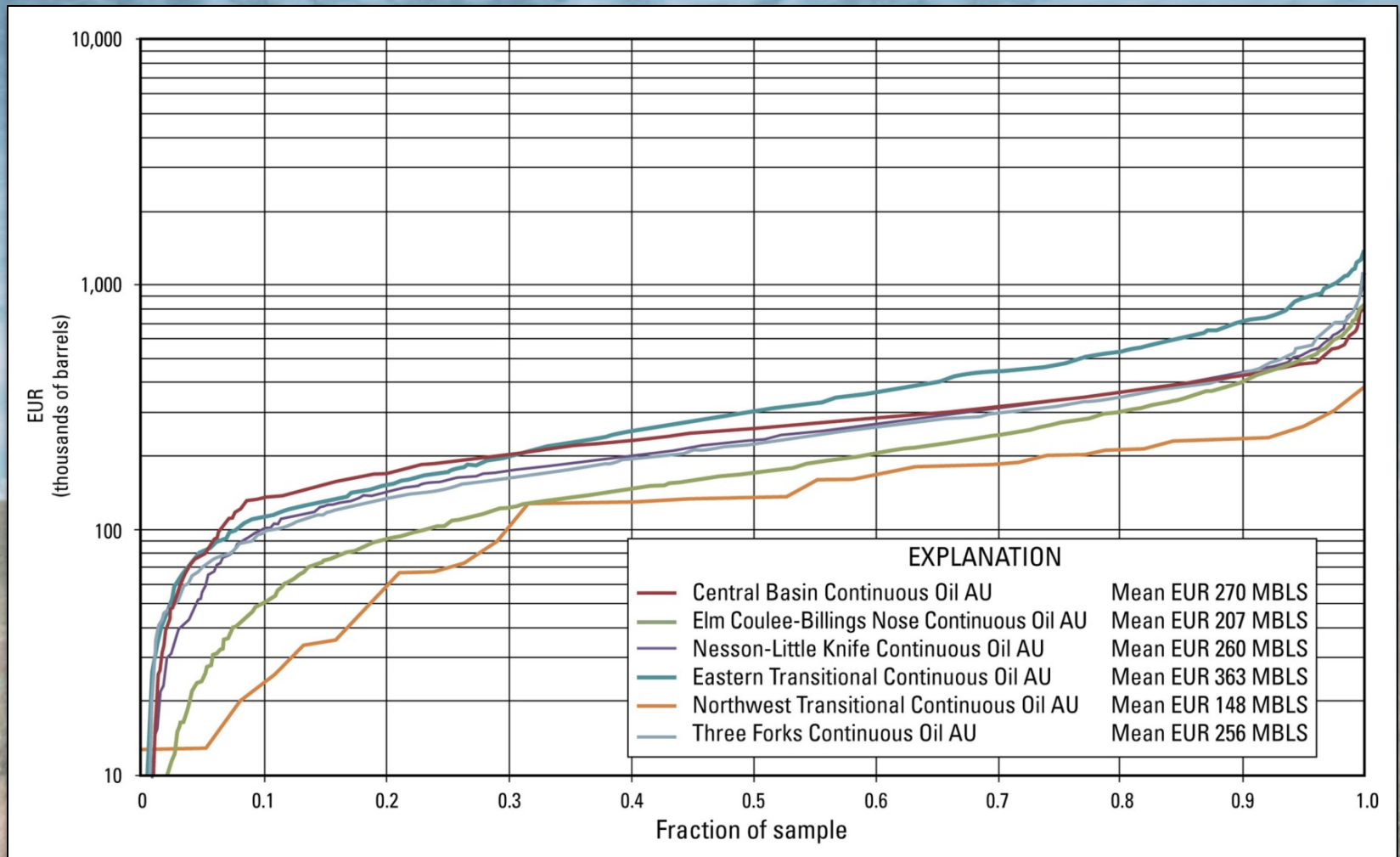
Methodology



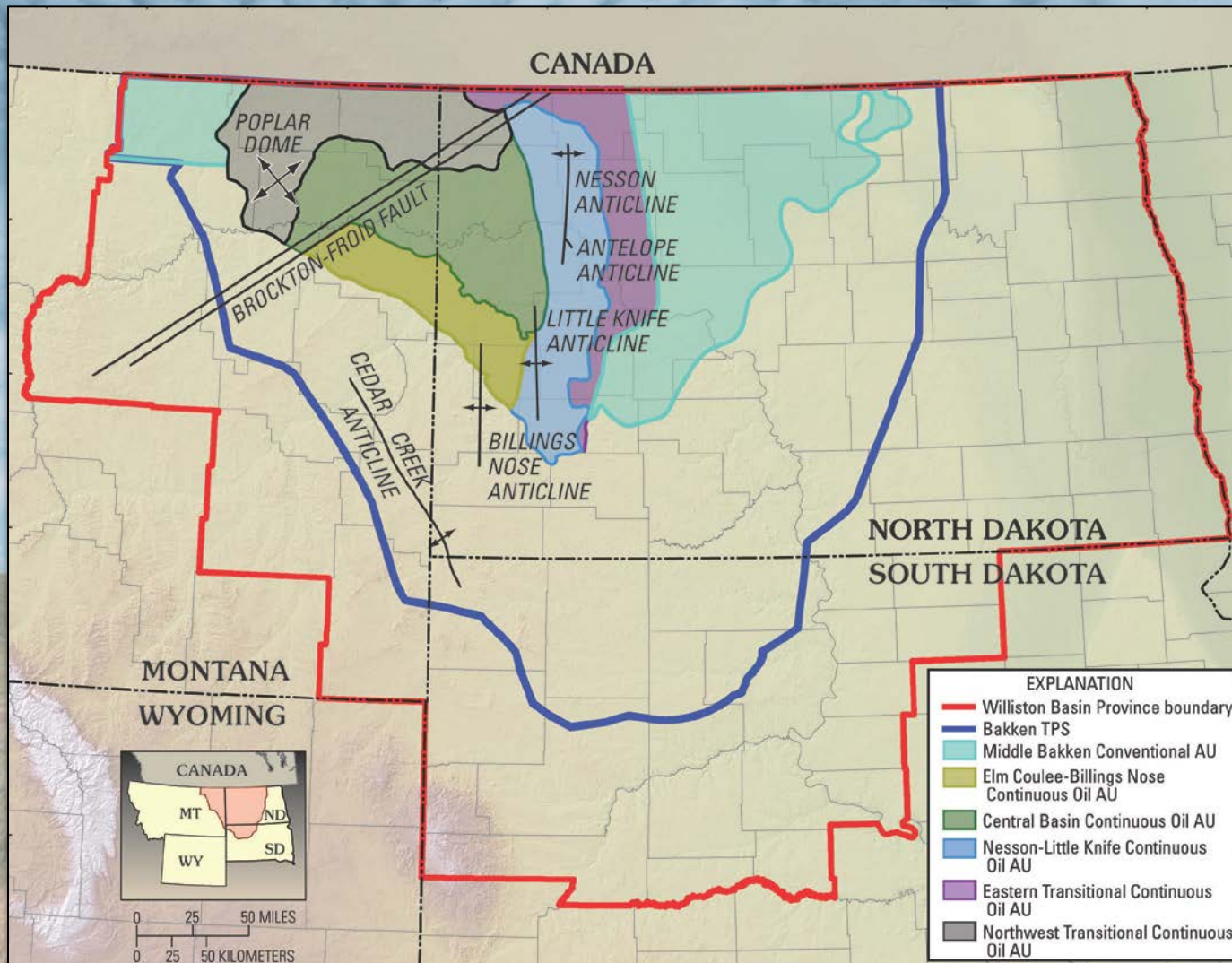
Distributions

- Assessment unit (AU) area
- Area of sweet spot
- Area of non-sweet spot
- Cell sizes
- Number of cells
- Estimated ultimate recovery (EUR)
- Success ratio

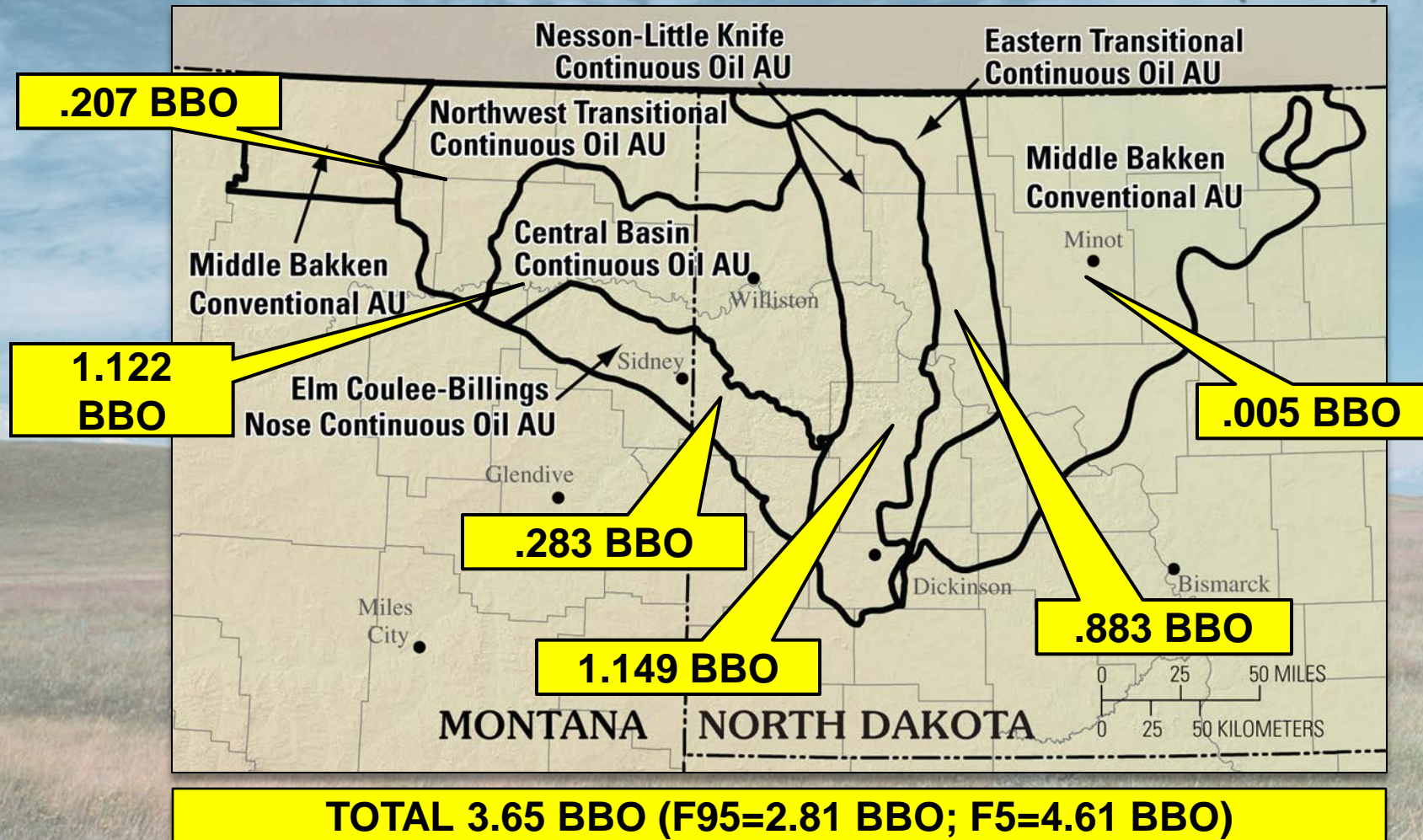
Estimated Ultimate Recoveries



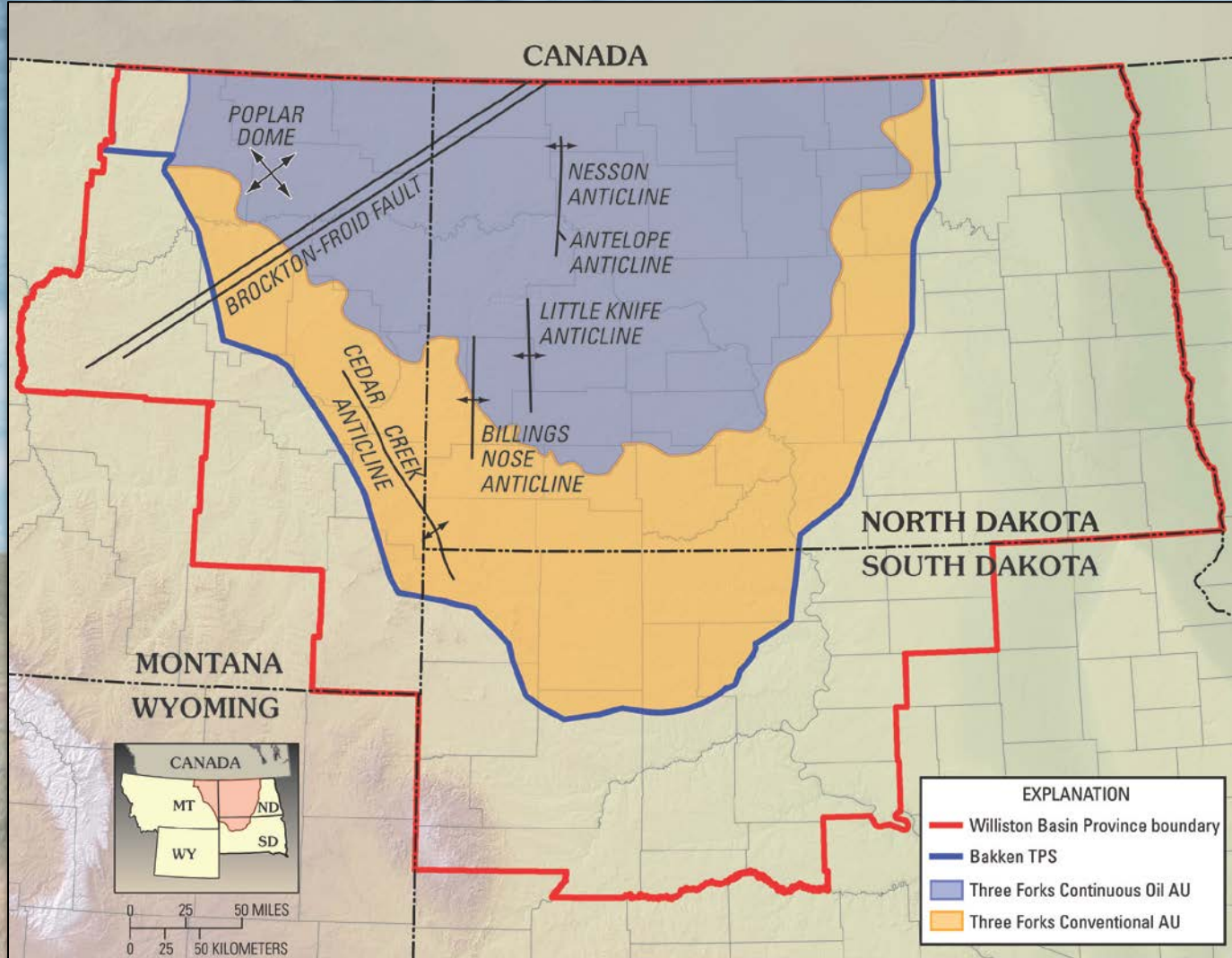
Bakken Formation Assessment



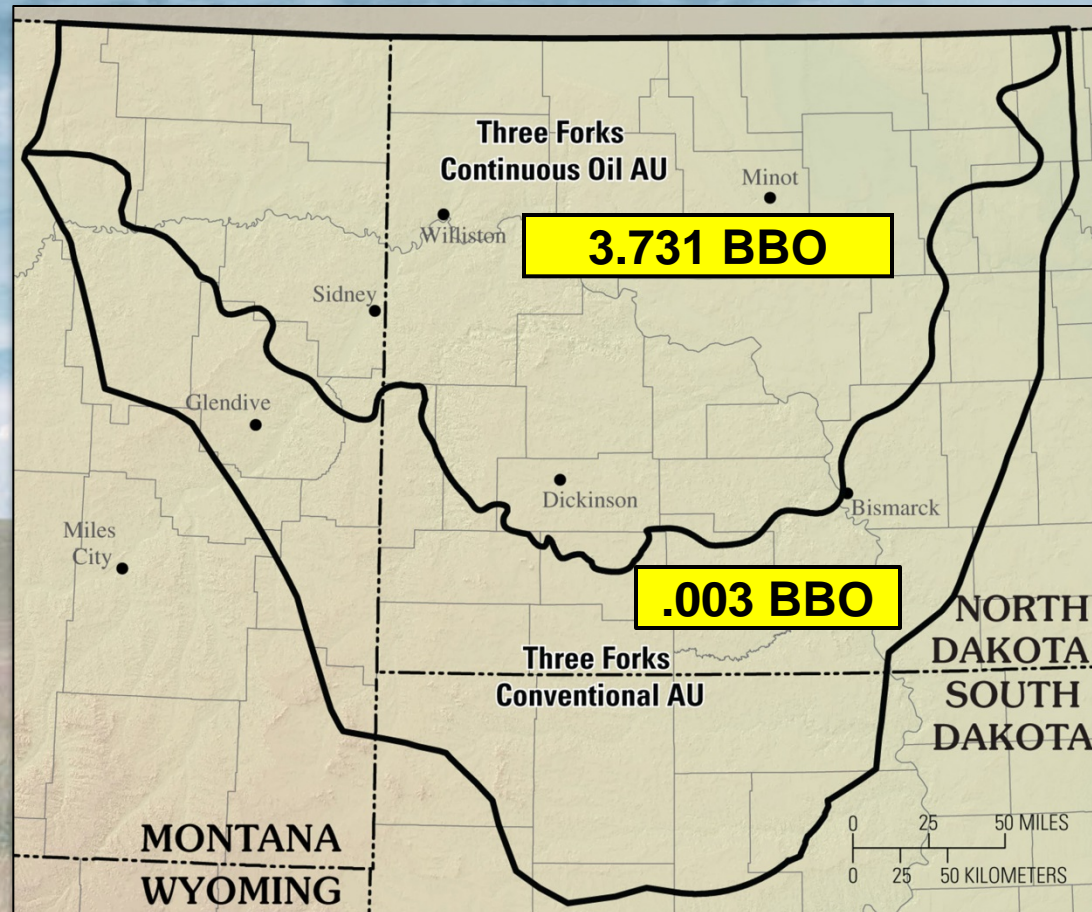
Bakken Formation Assessment Results Per Assessment Unit Mean Volume in Billions of Barrels of Oil (BBO)



Three Forks Formation Assessment



Three Forks Formation Assessment Results Per Assessment Unit Mean Volume in Billions of Barrels of Oil (BBO)



TOTAL 3.7 BBO (F95=1.6 BBO; F5=6.8 BBO)

Bakken and Three Forks Formation Assessment Summary

Undiscovered, Technically Recoverable Resource

Continuous Oil Resources (6 Assessment Units)

- Oil: 7.4 billion barrels of oil (BBO)
- Associated Gas: 6.726 trillion cubic feet of gas (TCFG)
- Natural Gas Liquids: 0.527 billion barrels natural gas liquids (BBNGL)

Conventional Oil Resources (2 Assessment Units)

- Oil: 0.008 billion barrels of oil (BBO)

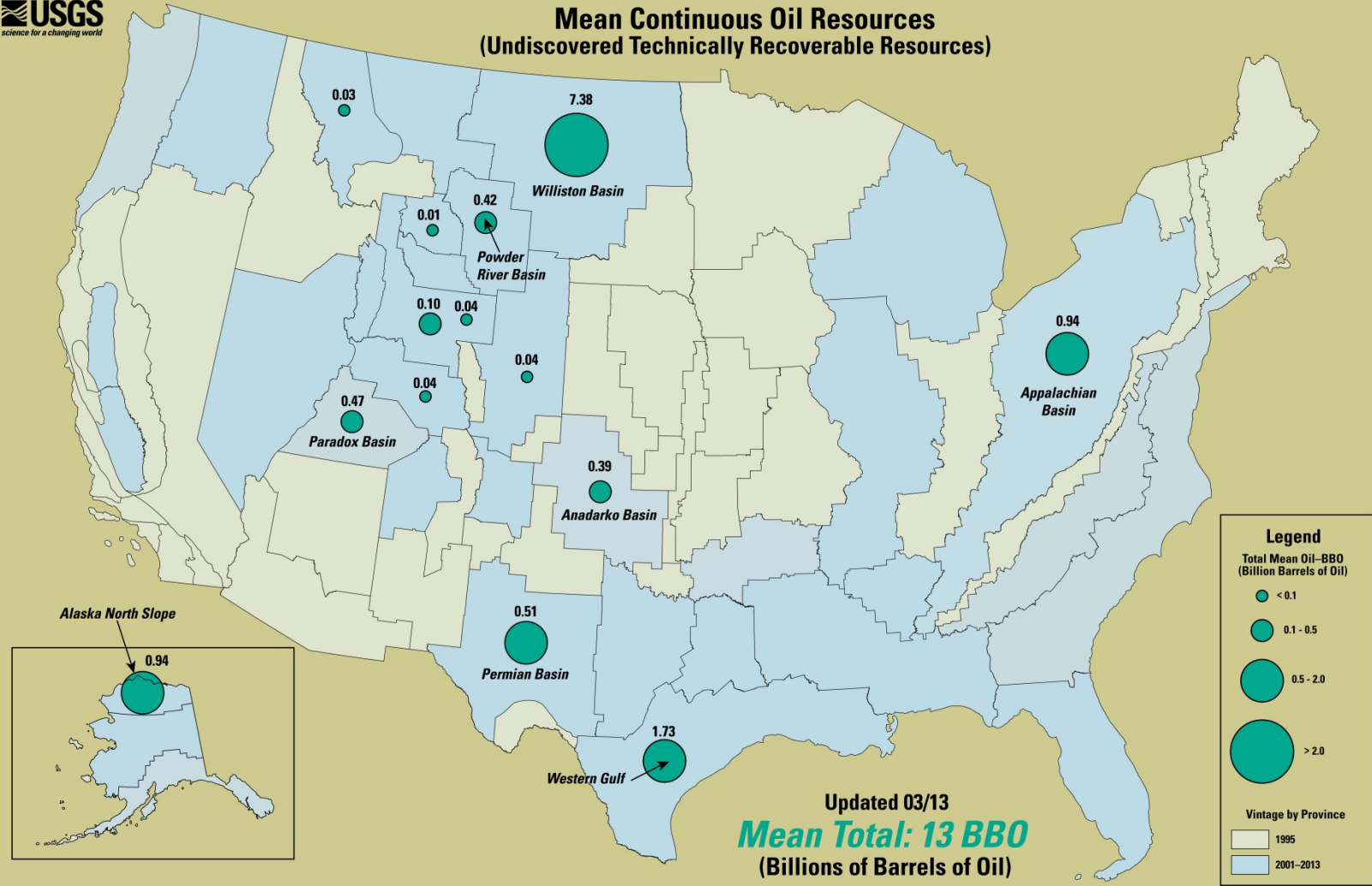
7.4 BBO (F95=4.4 BBO; F5=11.4 BBO)

Bakken and Three Forks Formations:

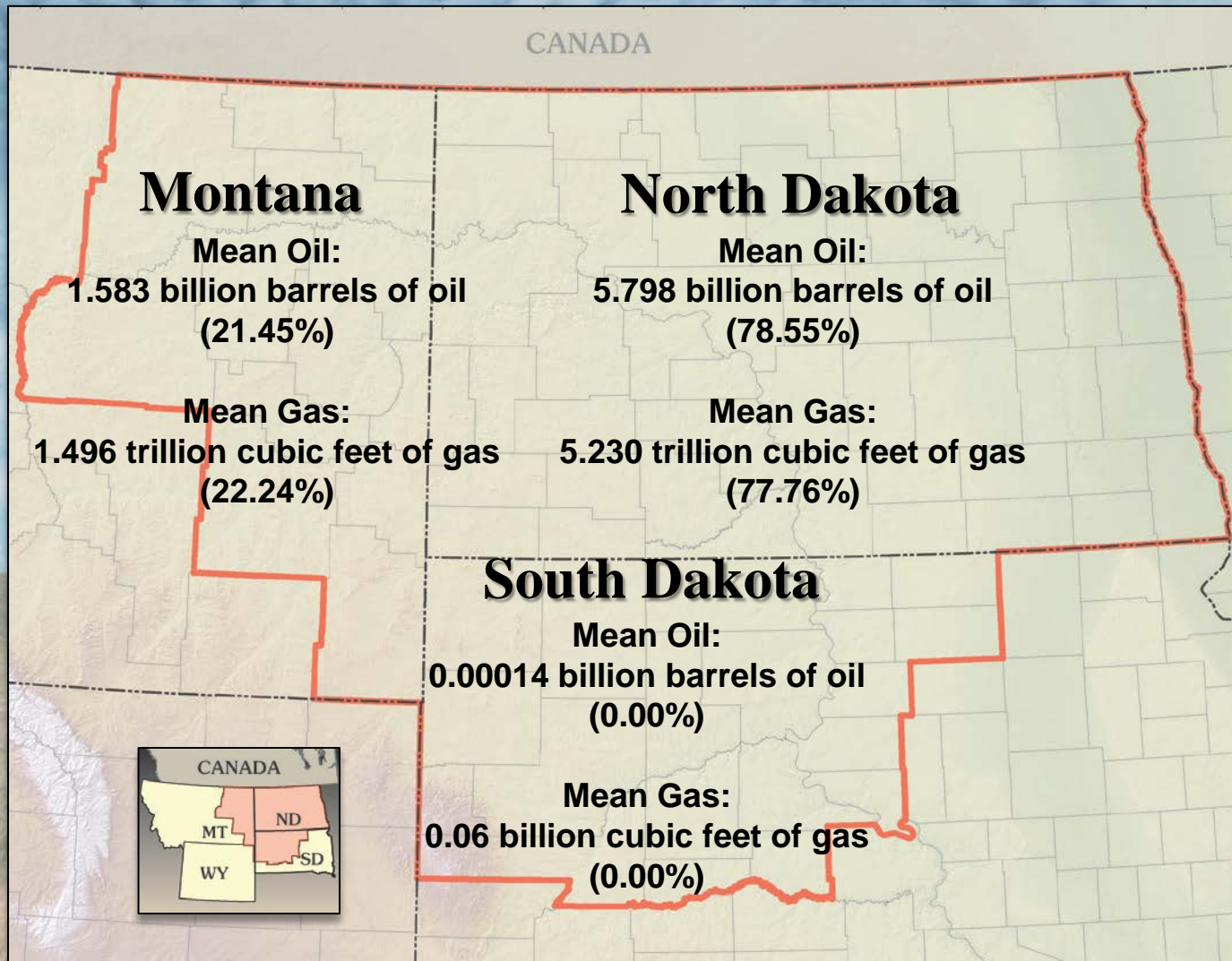
Largest Continuous Oil Accumulation Assessed by the USGS



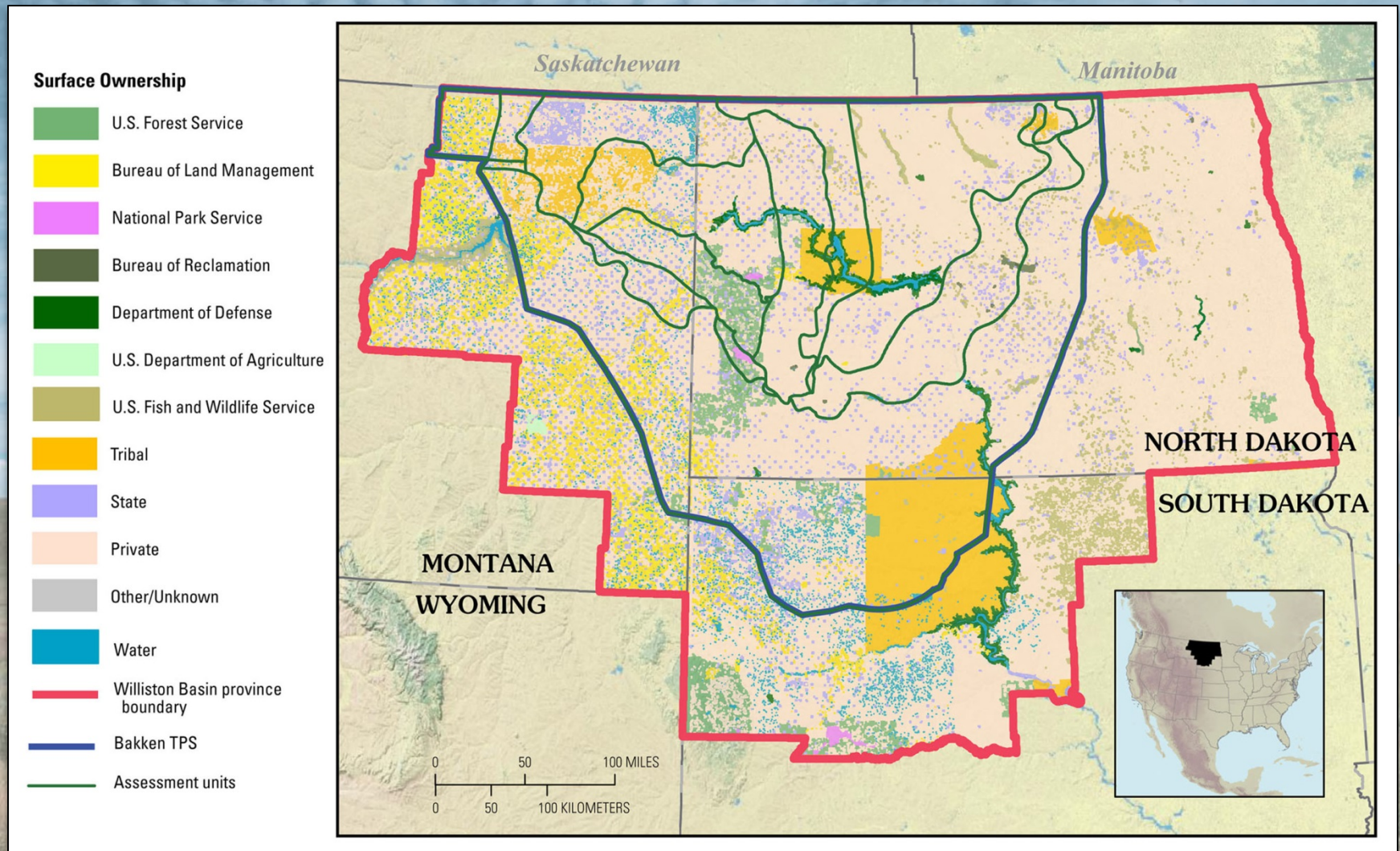
Mean Continuous Oil Resources (Undiscovered Technically Recoverable Resources)



Resource Allocations



Surface Ownership



Surface allocations from MT Bureau of Land Management, 2007

The End



*Photo courtesy of Dave Ferderer, USGS
Photo location: Theodore Roosevelt Nat'l Park, ND*